COLLIDER-ACCELERATOR DEPARTMENT

COLLIDER USERS TRAINING

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General Employee Radiation Safety Training

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Conventional Safety Issues At The C-A Complex

INFORMATION GUIDE

YEAR 2001

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COLLIDER USERS TRAINING

LEARNING OBJECTIVES OR WHY TAKE THIS COURSE?

This Course is required if you want unescorted **access** into Collider Experimental Areas, thus requiring you to have facility specific knowledge. To perform **work** in the experimental areas you must read and acknowledge the Skill of The Craft Work Plan for the specific experiment. Training specific to certain experiments may also be required **prior to working** in these areas. Information about experiment specific training can be obtained from the Liaison Physicist.

This course provides you with basic information about the access control system at the Collider. Specifically, this course covers the physical design features and administrative controls that are used to prevent accidental exposures to radiation and conventional safety hazards. The General Employee Radiological Training incorporated into this course will allow Users access to radiologically Controlled areas that *do not* require personal dosimetery (TLDs) through out the laboratory.

You will also learn about Stop Work, working safely with compressed-gas, Enhanced Work Planning, and Oxygen Deficiency (ODH 0) Hazards. Additional ODH training is required for access into the refrigerator building 1005R. The response to emergencies and the guidelines for control of emergencies will also be presented.

In addition to ionizing radiation hazards, experimental areas may contain hazards posed by:

- heavy objects,
- mechanical equipment,
- overhead cranes,
- heights,
- high magnetic fields,
- hot and cold surfaces,
- steam,
- high-voltage and high-current electrical systems,
- noise
- oxygen deficiency from release of helium or nitrogen,
- radio-frequency radiation, and
- contamination and oxygen deficiency from smoke and fire.

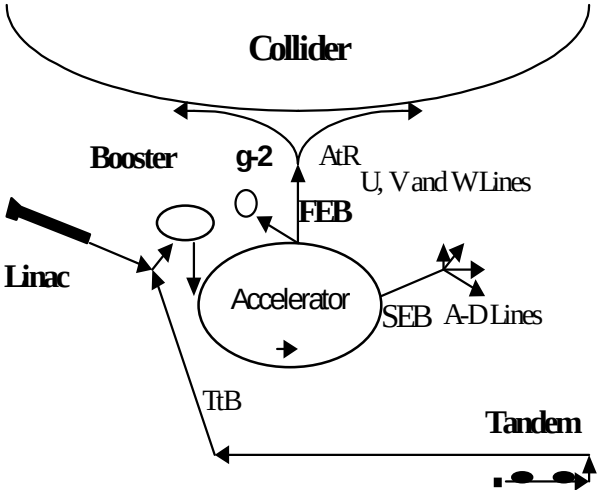
We strive to maintain an excellent safety record in such a complex environment without undue inconvenience to the C-A (Collider–Accelerator) user. With your help, over the last few years we have significantly reduced fire losses, radiation dose, unusual occurrences, environmental releases and injuries.

We can assure the continuity of this safety record only by having the active cooperation of each individual who has access to the experimental areas. Each of you should familiarize yourselves with C-A safety

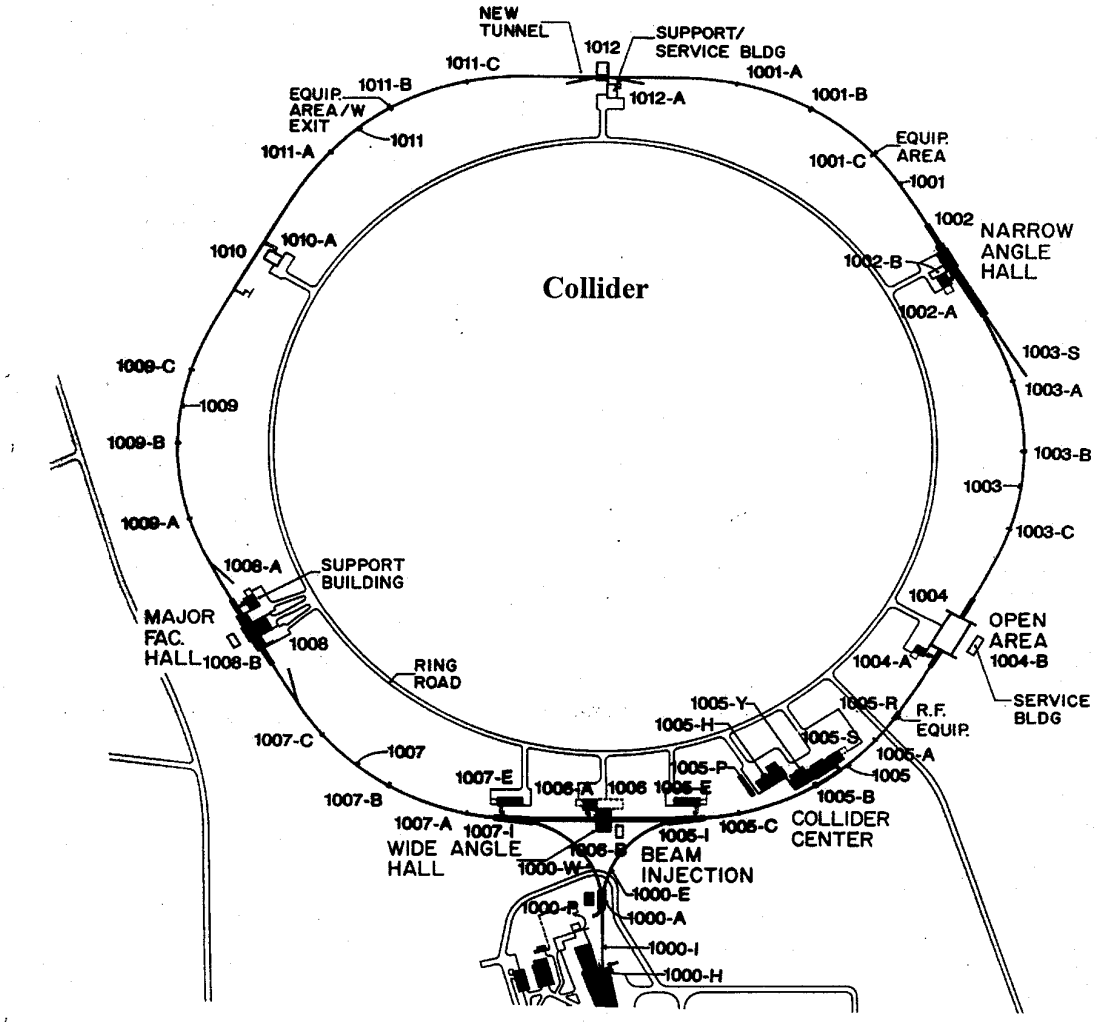
regulations, procedures, and the Local Emergency Plan. This training allows **access** into experimental areas at the Collider. **To perform work in the experimental areas may require additional experiment specific safety training.**

FACILITY DESCRIPTION

The Collider- Accelerator (C-A) complex consists of the includes the Tandem Van De Graaff, LINAC, AGS, and Booster accelerators, which deliver particles to the Relativistic High Energy Ion Collider.

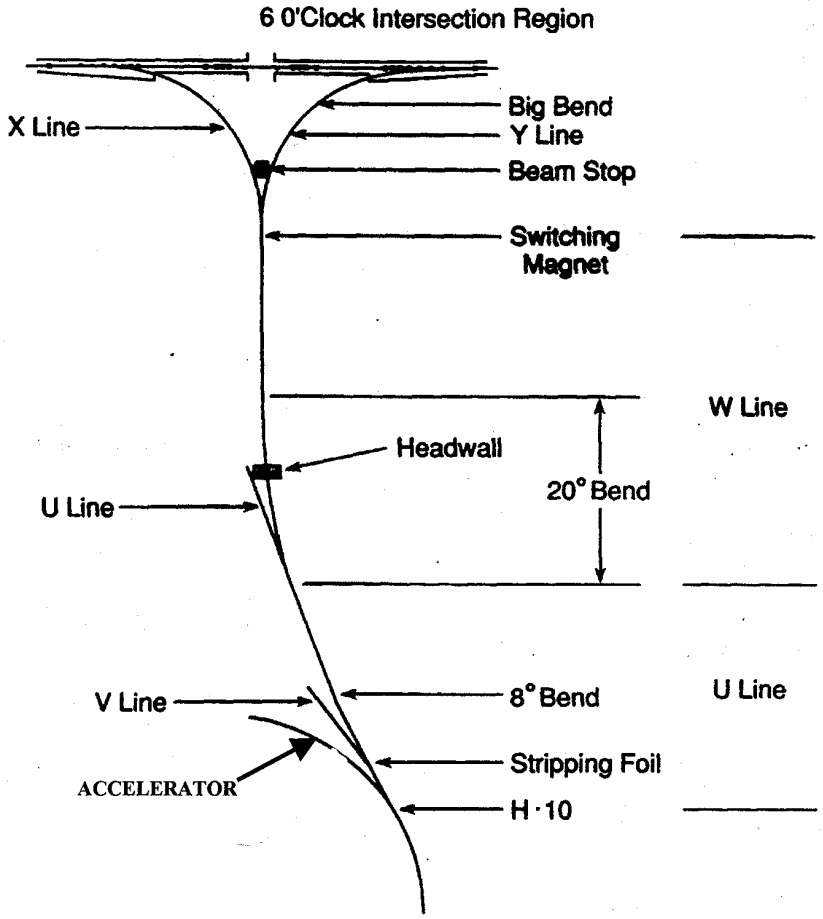


COLLIDER RING



The Collider portion of the complex currently has five experiments in operation / construction.
BRAHMS: Located in building 1002, at the 2 O'clock position along the collider.
PP2PP: Located at the 2 O'clock position along the collider.
STAR: Located in building 1006, at the 6 O'clock position along the collider.
PHENIX: Located in building 1008, at the 8 O'clock position along the collider.
PHOBOS: Located in building 1010, at the 10 O'clock position along the collider.

ACCELERATOR TO COLLIDER TRANSFER LINE



C-A CONDUCT OF OPERATIONS

During C-A operations, contact the C-A Operations Coordinator (OC) (x4662) regarding any problem; the OC can make all the necessary notifications or arrange for assistance.

You can determine if the C-A is operational or shutdown by reading this information from TV monitors located throughout the C-A Complex. During maintenance periods, all scheduled operational related maintenance must be done with the authorization of the appropriate Divisional Maintenance Work Coordinator. All C-A operations must have the required authorization. Required authorizations are listed in the C-A Operations Procedure Manual. Lead-personnel are to be appropriately trained. If requested, you must satisfy C-A requirements for authorization (e.g., working on a system declared as "critical").

Responsibility for the safe and reliable operation of the Collider-Accelerator complex resides with the on-duty Operations Coordinator. The Operations Coordinator is the shift supervisor for the operating personnel and the focus for all operations related questions.

The Collider-Accelerator complex is made up of a number of facilities. They are the Tandem Van De Graaff, the Linac, the accelerator ring, the main magnet power supply, the A, B, C, D, U, and V beam lines, the Tandem to Booster Line (TTB), the Booster, Collider, the accelerator to collider transfer line and the secondary-beam experimental area. During operations, all operations, safety, or schedule problems in any of these areas must be reported to the Operations Coordinator first.

During a shutdown period, all problems are to be reported via the existing supervisory staff (Liaison Physicist).

RADIATION HAZARDS

PROMPT RADIATION

The most significant source of radiation at the collider is due to prompt radiation. That is radiation occurring while the collider is in operation. At the collider prompt radiation is found in the primary beam line and the intersection region at each experiment.

A Primary beam area is any interlocked enclosure designed to prevent access to uncollided beam. These areas include AGS to RHIC (AtR) Transfer line, U and W lines, and the Collider Tunnel (including the intersecting regions). A fatal dose of radiation may occur as a result of direct exposure to accelerated beam or operating RF systems. RF Storage and Acceleration Cavities located in the beam line at the 4 o'clock region is an x-ray hazard.

No occupancy is permitted in primary areas when beam is on or RF cavities are enabled.

RESIDUAL RADIATION

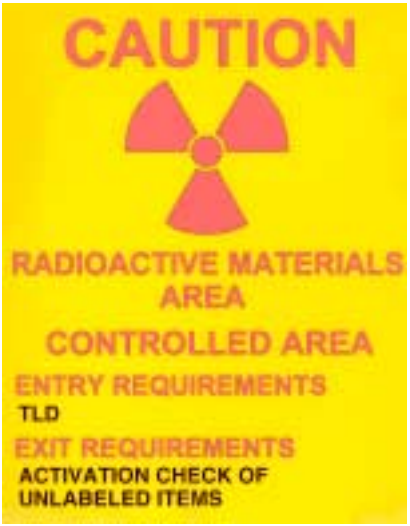
Residual radiation or activation can occur when the accelerated beam interacts with matter. This activation process can occur in the beam stop locations as well as other high interaction areas. These areas are posted with radiological signs.

GENERAL EMPLOYEE RADIATION TRAINING (GERT)

GERT training allows you unescorted access in to CONTROLLED areas at the Collider. The maximum allowable radiation dose permitted under GERT training is 100 mrem/year. This training does **not** allow you to enter any radiological area that requires a TLD (thermoluminescent dosimeter). Such areas include Controlled Areas that indicate a TLD is required for entry (check postings), Radiation areas, or High Radiation Areas, Airborne Radioactivity Areas, Contamination Areas, and Radiological Buffer Areas. The Collider tunnel is posted a Controlled Area – TLD Required.

RADIATION POSTINGS

Read all Radiological Postings carefully. They are used to alert personnel to radiation and radioactive materials. They will indicate what requirements are necessary for entrance and exit of the area.



RADIATION LEVELS, AREA NAMES, AND TRAINING REQUIRED

Allowable Radiation Level	Area Name	Training Course(s) Required
< 5 mrem in one hour < 100 mrem in one year	Controlled Area	Collider Users Training
> 5 mrem in one hour < 100 mrem in one hour	Radiation Area	Rad Worker 1 Training And Collider Users Training
> 100 mrem in one hour < 50,000 mrem in one hour	High Radiation Area	Rad Worker I Training And C-A Facility Specific Training

PRICE ANDERSON ACT AMENDMENTS (PAAA)

It is important to make you aware of the absolute requirement to follow all radiation safety rules at C-A facilities. Federal law (PAAA) provides for enforcement penalties if you do not follow the rules fully. Personnel have been the subject of criminal investigations when found to willfully remove a radiation barrier. Thus, we request that you pay particular attention to the radiation safety rules that follow.

Are the staff or Users at the C-A department accepting additional legal liabilities when signing documents related to compliance with radiation safety rules under the Price-Anderson Act Amendments? The short answer is that staff or User incurs no personal liability under the provisions of the Act unless he/she intentionally acts to violate the radiation safety rules.

The Price-Anderson Act sets up a regulatory scheme for enforcement of radiation safety rules, including radiation protection standards (10 CFR 835). Failure to comply with those rules, or to identify and report a non-compliance to DOE, subjects the Laboratory, not an employee, to an enforcement action.

When signing documents related to radiation safety, an employee or User is essentially confirming that he/she will do his/her assigned work according to the rules. The signature does not mean that the employee is guaranteeing that the work will be carried out perfectly or that there is no potential for a violation. It does mean that the employee is performing his/her duties to the best of their ability and has made a good faith effort to comply with the radiation safety rules. A "good faith effort to comply with the rules" means that the employee has familiarized him/her-self with the requirements of regulations that fall within his/her area of responsibility. Having done so, he/she should be in a position to approve or sign-off on procedures or training to carry out work involving radiation safety.

WARNING

It should be understood that any User who intentionally violates any regulation, regardless of whether the User signs any document related to compliance, might be subject to criminal prosecution or other disciplinary action.

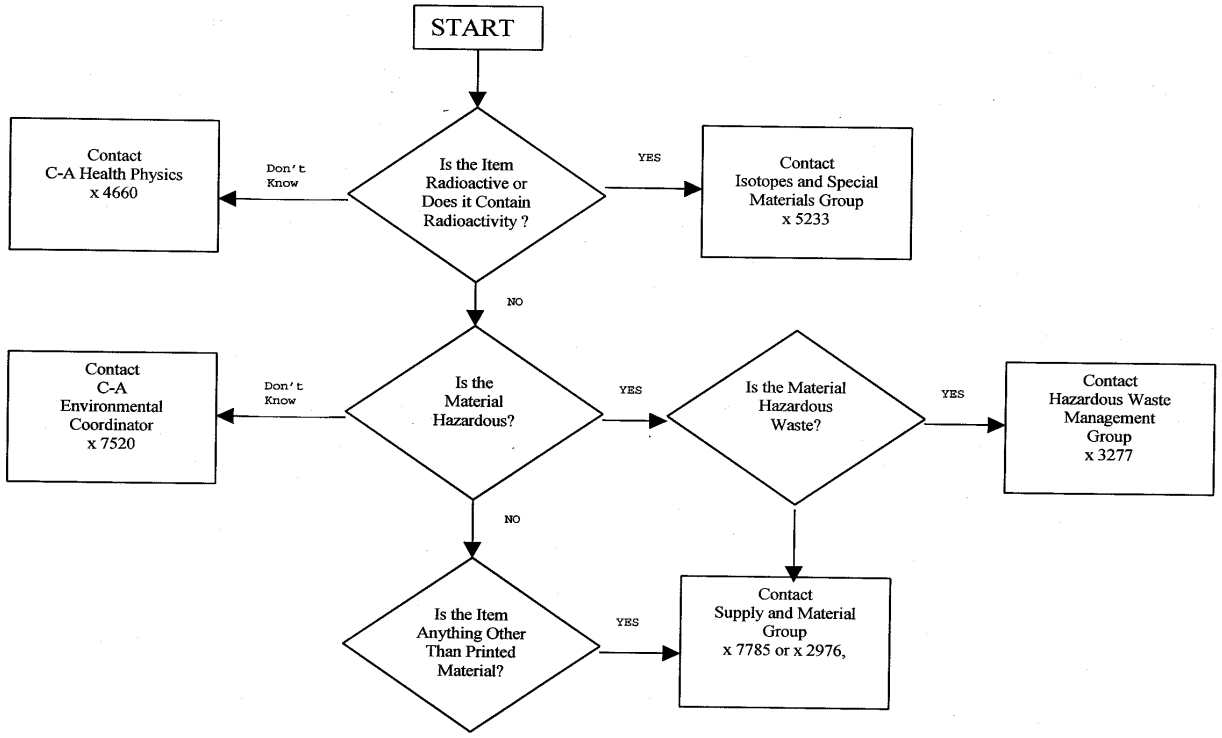
DELIVERIES TO C-A FACILITIES

In recent years, the delivery of materials to C-A has become complicated due to our attempt to comply with the Price Anderson Act Amendments. Under Price Anderson, we are required by Federal law to obey all radiation safety rules or face stiff penalties if we do not. All persons, including delivery people, who enter Radiation Areas must wear a TLD and be escorted by a trained Radiation Worker, or they must be a Radiation Worker.

To ensure that **delivery people do not enter radiation areas**, the Department requires that all deliveries for the C-A complex be made to building T89. Arrangements can be made with the Main Control Room, (x4662), for off-hour deliveries. When the delivery is made to the MCR, personnel there will then contact the addressee. Under no circumstances are deliveries to be made to

other buildings in the C-A complex without approval of the C-A ESHQ Division Head (x3271, pager 4210). When placing an order, inform vendors to put your name on the package (packages arriving without a name will be sent back) And state that deliveries are to be made to **building T89.**

IF YOU ARE SHIPPING MATERIAL FROM THE C-A COMPLEX TO OFF SITE, THEN ASK YOURSELF THESE QUESTIONS.



RADIATION EXPOSURE CONTROL

People have always been exposed to radiation from natural sources. We are exposed to this radiation from our environment, from materials inside our bodies, and from certain man made sources such as medical x-rays. The average radiation dose to a member of the general population is about 360 mrem/year. This amount is a combination of both natural background and man made sources of radiation. Natural background radiation is by far the largest contributor (about 300 mrem/year) to radiation doses.

C-A EXPOSURE PHILOSOPHY

Radiation Exposure at C-A Must:

- Have a Net Benefit
- Be **A**s **L**ow **A**s **R**easonably **A**chievable (**ALARA**)

Once an experiment is configured and enabled, invaluable scientific information is obtained. Estimates of the economic worth of this information are difficult to evaluate. It is assumed that this research has a net benefit.

Eating, drinking, or smoking in a radiological area increases the time spent in the area, and correspondingly the dose, without increasing the net benefit. Therefore eating, drinking, and smoking are prohibited in all Radiation and High Radiation areas.

ALARA STRATEGIES

The basic ALARA strategy on the part of the User revolves around reducing dose by the efficient use of time, distance, and shielding. Reduce the time spent in radiological areas, increase the distance from sources of radiation, and use shielding whenever possible. ALARA is also incorporated into design and operations. Obey all signs and postings. **Do not enter** any area restricted for radiological purposes unless properly escorted.

Our greatest dose reduction at the C-A complex has come by the way of improvement projects. We have improved the reliability of the vacuum system, injection system, and extraction system. The redesign and use of radiation tolerant materials and techniques have resulted in fewer repairs of equipment which in turn reduces the dose burden because we are working less frequently on broken activated equipment.

. RADIOLOGICAL AREA DEFINITIONS

Controlled Area -- any area where access is controlled due to the presence of radiation above natural background levels or due to the presence of man-made radioactive materials. As a minimum, these areas are posted “Controlled Area.” An individual may receive a dose less than 5 mrem in one hour or less than 100 mrem in one year.

Radiation Area -- any accessible area where an individual may receive a whole-body dose greater than 5 mrem in one hour at 30 cm (1 ft) but less than 100 mrem in one

hour. As a minimum, these areas are posted "Radiation Area, TLD Badge Required."

High Radiation Area -- any accessible area where an individual may receive a whole-body dose greater than 100 mrem in one hour at 30 cm (1 ft). As a minimum, these areas are posted "Danger, High Radiation Area, RWP and TLD and SRDs Required."

LABELS FOR SHIELDING

For large concrete and steel blocks, Colored **Radiation Symbols** with the word **"RADIOACTIVE"** are painted on the shield material to indicate the residual maximum radioactivity level at 12 inches from any surface.

IF COLOR IS	RADIATION LEVEL IS
GREEN	< 5 mrem/h
YELLOW	5 to 100 mrem/h
RED	> 100 mrem/h

Lead bricks, small concrete and steel blocks may have their ends painted with the appropriate color.

ACTIVATION CHECK REQUIREMENTS

Objects that are exposed to primary beam may become radioactive and are to be handled with special care to avoid excessive and unnecessary exposure. In order to remove activated items from the experimental area a Radiological Control Technician (RCT) must check and tag the item before it is handled by Users or others at BNL. Check the postings for the area to see if activation checks are required.

CHRONIC RADIATION DOSE

Chronic dose is one received over a long period of time, usually repeatedly, in small increments. Examples of chronic doses include the dose received as a Radiological Worker at BNL (occupational dose) and the dose from background sources. Chronic dose may present an increased risk of radiation induced cancer developing later in life ***There are no observable short term effects associated with chronic radiation dose.*** Within the allowed dose limits, this increased risk of radiation induced cancer is extremely small, especially when compared to risks people accept in their everyday lives. Prediction of long term effects are based on studies of people exposed to large doses and include sample populations such as survivors of Hiroshima/Nagasaki, radium dial painters, radiotherapy patients, and uranium miners. The effects observed from these high doses are extrapolated to lower doses by assuming a linear correlation. There has been some discussion about the appropriateness of these extrapolations from high dose to low dose, but scientific opinion generally concurs that these estimates are

conservative and appropriate for setting dose limits.

ENTRY MODES AND STATUS INDICATORS

A flow diagram shows the steps the C-A Department takes in going from the highest level of restriction to the lowest:

ACCESS PROHIBITED

⬇

BEAM DISABLED

⬇

HP SURVEY FIRST, THEN CONTROLLED ACCESS

⬇

CONTROLLED ACCESS DECLARED BY MCR

⬇

RESTRICTED ACCESS DECLARED BY MCR

⬇

RESTRICTED ACCESS

The PASS (Particle Accelerator Safety System) located within the Collider portion of the complex, is designed to control access to beam areas and detect excessive radiation levels outside shielding via radiation monitors (chipmunks). Additionally the PASS system detects Oxygen Deficiency Hazard (ODH) conditions, turns on alarms, ventilation equipment, and secures some electrical equipment. The major interface used in the PASS System consists of access gates. Entry is made possible through the use of access cards and keys. The PASS gate entries require **one card/key for one-person access only!** Multiple access is considered a serious violation of procedures, and is subject to disciplinary action.

ENTRY AND EXIT GATE BOXES

The entry and exit boxes at gate areas located at the collider require the use of an Access Card and or CA Keys (for Controlled Access) to enter. A system of lights on these boxes indicates the machine's operational access status.

Entry and Exit Gate Boxes at the Collider

GREEN LIGHT - RESTRICTED ACCESS,
To enter place card on reader, get green light on reader, open door. To exit turn knob to open door (card not required).

YELLOW LIGHT - CONTROLLED ACCESS,
To enter confirm with the experiment shift leader, accessibility to the area. Get a key from MCR supervisor. Telephone MCR (x4662) from the access gate, be observed by video camera, a tone will sound when gate can be opened. When exiting you must telephone the MCR and when a conformation buzzer is sounded, open the

gate and exit. **Failure to contact the MCR will require the MCR to re-sweep the area which will result in unnecessary delay.**

RED LIGHT – ACCESS PROHIBITED,
No access is allowed. Beam is already on or is immanent.

BEAM IMMINENT ALARM CRASH CORDS

Crash Cord and Lights in the Collider

In the Intersecting Regions of the Collider, Experimental Halls, and in the Collider Tunnel, there are Orange Crash Cords and Orange Strobe Lights.

If you are in any of these areas and an orange strobe light goes off and an audible alarm is heard this is a signal that beam is imminent.

If you observe the visual and audible warning signals you must pull a crash cord or open any exit/entry gate from the inside.

do not panic, you have time, 60 seconds minimum before beam is on..

Pulling the crash cord or opening an exit gate will interrupt normal operations and prevent beam from entering the area. After pulling a crash cord or crash bar, call the MCR and notify them where you are located.

Do not tamper with cash cords. Do not hang tools or clothing on the crash cords, this may stretch them out causing reset errors. Do not block access gates open. Any modifications to the PASS system (such as entry gates) must be pre-approved by the C-A Access Controls Group.

GOLDEN RULES FOR RADIOLOGICAL AREAS AT C-A

- Do not climb over or defeat barriers
- Do not ignore signs, labels, alarms or warning tags

For all postings that indicate a TLD is required, Users must take the required Radiation Worker I Training Course, obtain and wear a TLD, *prior* to entry into these areas.

RADIATION SOURCES

Beta, gamma and neutron sources produce radiation levels that may travel many feet in air. The radiation level drops rapidly as the inverse square of distance from the source. This is because most sources are point-like objects. The Federal rules define sealed sources as any radioactive item manufactured for the sole purpose of using the emitted radiation. A common example of a sealed source is an instrument calibration source. if you are not sure about the definition of a sealed source, then contact an RCT (x4660) in order to make a determination regarding the rules.

Sources should be stored in shielded containers. Many areas have two or more source boxes. If you are using a source in your work, then the following rules apply even if you obtained the source from another BNL Department or Division:

- Have all sources inventoried and leak-checked every six months by the C-A Health Physics Office (x4660).
- Notify BNL's Isotopes and Special Materials Group prior to shipping a source to or from BNL (Contact the BNL IS&M Group at 631-344-5233).
- Complete the sealed-source inventory procedure and keep it with the source.
- The Health Physics Office must be contacted if sources are to be moved.

If you are responsible for a sealed source, then DOE Orders and Federal Law require you to keep track of it in a way that can be audited by the Federal government. Additionally, you must be a trained and qualified "Source Custodian." Contact the C-A Source Custodian (x5636) for training.

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LOCK OUT TAG OUT

Lockout/Tagout (LOTO) is used at the Laboratory for personnel safety for energy sources. It is recognized by the presence of a red tag or a lock, and it requires that you obey specific OSHA requirements. In some cases, the equipment cannot be locked and only the red tag is used. In most cases, however, LOTO boots or other commercially available locking devices can be added to the device to enable complete LOTO. Contact the C-A ES&H Coordinator (x 7200, page 5940, or x 4619, page 5909) for more information.

To prevent accidental radiation exposure, electrical shock or other hazards from different sources of energy, the LOTO shall only be removed by the individual who attached it. When the individual who attached the LOTO is not available, a committee of three employees must be formed, and the membership of the committee is designated in the C-A OPM. These persons will be familiar with the area or equipment under the LOTO and they shall determine if it is safe to remove the red tag and lock. Contact the MCR (x4662) or the C-A ES&H Coordinator (x 7200, page 5940, or x 4619, page 5909) if you need to remove someone else's LOTO. A similar procedure is used for Radiation Safety (RS) LOTO.

All personnel who have to work on electrical circuits that are powered and are controlled by circuit breakers, disconnect switches and/or fuses must LOTO the circuits. OSHA, BNL and C-A require that all workers performing these tasks be trained in LOTO. If you or your co-workers fall into this category, then contact the C-A Training Manager (x5800) for training.

RADIATION SAFETY LOCK OUT AND TAG OUT (RS LOTO)

Liaison Physicists, Liaison Engineers, and members of the Radiation Safety Committee must follow a specific procedure in order to lock out and tag out equipment or beam lines for radiation protection. Equipment or beam lines are generally locked out during barrier modifications or removals, or whenever the PASS system alone does not provide the required protection. This lockout is required in order to limit beam parameters such as polarity and intensity, or whenever a beam line is not authorized to operate. **do not** alter or otherwise tamper with equipment that bears the RS LOTO tag.

CHIPMUNKS AND RADIATION SURVEYS

Radiation monitor - Chipmunks

During a running period, radiation surveys are updated daily, and continuous area monitoring is performed by instruments, called Chipmunks, most of which alarm in the Main Control Room. During shutdowns, surveys are done initially, and whenever an RWP (Radiation Work Permit) is used. Records of the surveys are maintained by the C-A Health Physics Office. Survey data is normally attached to the permits and copies are maintained at the job site.

Chipmunk readings are also recorded continuously and maintained in a database for later retrieval and review. In addition to alarming in the MCR, Chipmunks are capable of alarming locally and are stationed at fixed locations in order to monitor high occupancy areas and other areas of interest.

Retrospective exposure rates for any area of interest can be determined by the staff at the C-A Health Physics Office.

The Chipmunk is set up like a street light with red, yellow and green indicators. A chipmunk will display a red blinking light for radiation levels greater than 20 mrem/h, and a yellow blinking light for levels greater than 2 mrem/hr. Normally chipmunks operate in the green range indicating nominal radiation levels. If you observe a chipmunk indicating in the yellow or red range, leave the immediate area, notify your collaborators to leave the immediate area, and then contact the Main Control Room for instructions.

There are over 100 chipmunk-monitoring devices in use at this time. They have pre-designated alarm levels established by the Radiation Safety Committee. Main Control Room Operators are trained to respond to alarms and investigate the cause, even if it means interrupting the physics program. Do not move or tamper with chipmunks.

SECURITY SYSTEM ORANGE TAGS

The devices sensed by the security system (PASS) must remain correctly connected. In order to help ensure that personnel do not disconnect or alter these devices without following the approved procedure, the Access Controls Group will identify devices with an **orange warning tag**. In the experimental areas, these tags alert personnel that the device is critical to safety and the operation of the PASS System. **Do not move** these devices since relocation will compromise their effectiveness. Contact the Main Control Room if these devices are inhibiting your work.

- Program disruption and/or electrical shock may occur by overlooking an orange warning tag.

- Tags and signs are often placed only on the front of equipment.

Look at the front of equipment

RADIATION SAFETY SERVICES

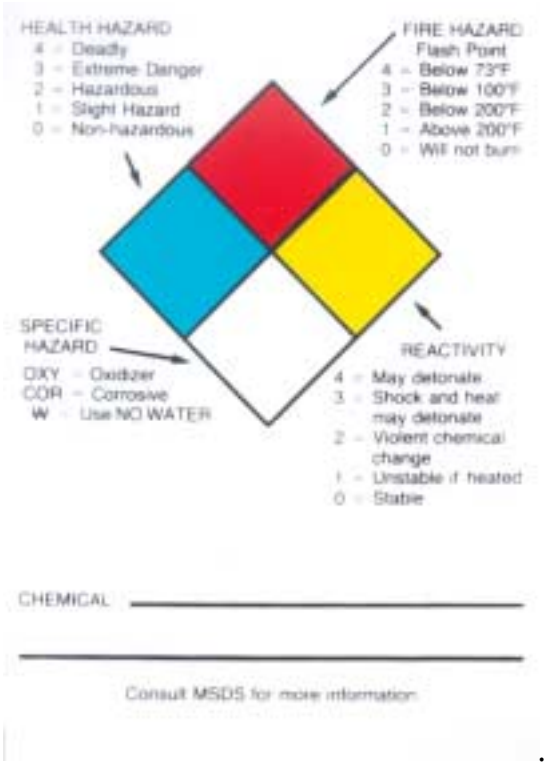
- Contact Health Physics Office.
- Pager 6189 (Digital Pager).
- Telephone 4660.

The Radiological Control Division provides the C-A with services that encompass several operational aspects of safety including radiation safety. They provide dose records, radiation surveys, RCT coverage for high-dose jobs, and review of RWPs for ALARA. They also assist in interpreting abnormal radiation levels.

During running periods, RCT coverage is provided on all shifts. During shutdown, services are provided from 8:30 a.m. to 4:30 p.m., Monday through Friday. Assistance is obtained by contacting the Health Physics Office (x4660), or pocket pager 6189 (digital pager), or by contacting the C-A MCR (x4662).

Special shifts for RCTs may be pre-assigned allowing for specific round-the-clock coverage when needed during a shutdown.

INFORMATION ON HAZARDS, YOUR RIGHT TO KNOW



You have the right to know about potential health and safety hazards in your workplace, whenever the potential for exposure to hazardous materials exists. You will be provided with specific safety and health information by the ES&H Coordinator. Contact the ES&H Coordinator at (x 7200, page 5940, or x 4619, page 5909). The Coordinator can provide you with information on the Laboratory's policy on hazardous information, how to obtain Material Safety Data Sheets (MSDS) and interpret them. Some of the information that can be found on an MSDS is the name of the chemical, manufacturer, hazardous ingredients, physical characteristics, fire and explosion hazard data, reactivity data, health hazard data, precautions for safe handling and safety control measures.

National Fire Protection Association (NFPA) diamonds appear on various materials containing structures and containers to the degree of hazard for these materials.

The ES&H Coordinator can also provide information on how to select and use protective equipment, and explain the labeling system used on chemical containers.

CHEMICAL SAFETY

For your safety, purchased chemicals are inventoried by the Laboratory prior to delivery for end use. If you bring un-inventoried chemicals on site you must contact the ES&H Coordinator (x 7200, page 5940, or x 4619, page 5909) to have these chemicals inventoried and bar coded prior to use.

MAGNETIC SAFETY

Where magnetic fields are present, a 5 Gauss limit is posted on doors of building, and on warning signs in the Collider tunnel.

Use extreme caution with iron and steel objects when working around magnets with large gaps (e.g., spectrometer magnets). Be sure magnets are not energized before the area is cleared of ferrous objects. Remember that the field may be effective at a surprisingly long distance. Follow all magnetic safety plans specific to your experiment.

East Face of the STAR Magnet
Orange barrier denotes 500 Gauss limit.

LASER SAFETY

All lasers on the experimental floor need to be reviewed and classified by the BNL Laser Safety Office personnel prior to initial use or following modification to a previously reviewed laser. Make sure you are aware of the safety requirements established for lasers in your area.

Lasers located at STAR

STAR Magnet Cooling System

MAGNET WATER COOLING

Magnet water cooling systems may incorporate electrical buses. They are operated under pressure and require special training to work on. Depending upon the location in the C-A complex, some magnet water cooling systems may have a radiation field associated with them. These are clearly labeled and should not be handled without proper training and authorization.

HARDHAT POLICY

Within the C-A complex you are required to wear a hardhat if you are in an area when an overhead crane is in constant operation. Do not continue to stand under objects being handled by the cranes. If a crane occasionally moves overhead, a hard hat is not required. If a load is passing overhead a hardhat is required.

At STAR and PHENIX you are required to wear a hardhat if people are working above you. *Construction areas* require a hardhat at all times.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Department safety policy states that each workplace should be created and maintained in a manner that minimizes safety and health problems. For some jobs, this is not always practical. In some cases protective clothing and equipment is required for safety. Plan your work in advance. Consider whether PPE may be needed. Contact the C-A ES&H Coordinator (x 7200, page 5940, or x 4619, page 5909) whenever PPE is to be used for approvals and reviews.

FIRE SAFETY

The fire safety program at BNL emphasizes prevention through the design of buildings and automatic protection. If you suspect a fire pull the fire alarm box and telephone 2222 or 911, Fire Rescue Group. Once a fire has been reported warn everyone in the area and evacuate as required. If you think you can combat the fire without putting yourself in danger, a fire extinguisher may be effective. **Never let the fire get between you and your escape route**. Use a fire extinguisher only if you are trained and it can be done safely. Only use a fire

extinguisher if you're confident in your ability to put out the fire safely. Determine what is burning and select the appropriate fire extinguisher. Fire extinguishers are classified according to their ability to handle specific types and size fires. If you have any doubts, let firefighters handle the situation.

FRAGILE EQUIPMENT

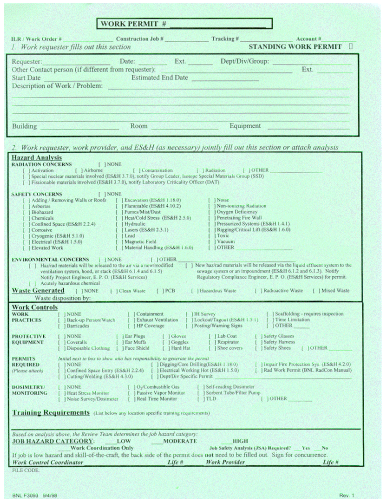
Many experiments at the C-A complex employ devices and equipment that are fragile such as vacuum windows, scintillation detectors, prototype detectors, electronic cards, connectors and cables. All of these devices require proper training and authorization prior to performing work on them. All Collider experiments have beryllium beam pipes installed. This material is fragile, and toxic. Protection is provided to prevent physical damage.

Care is always required in experimental areas to prevent damage to fragile components of the experiment

FLASH HAZARD

A Flash hazard is present when the potential exists for electrical equipment to arc producing a shock hazard, possible sparks and molten metal spray. This can occur in situations were electronic components and connections are exposed during testing. If a conductive tool is dropped into these areas a flash event may occur. Care is required in these areas to prevent any inadvertent electrical contact.

GREEN WORK PERMIT AND IN-HOUSE WORK PLANNING AND SCREENING AT C-A



WORK PERMIT #

STANDING WORK PERMIT

All internally initiated jobs at C-A must be screened for ES&H hazards. Green Work Permits are required for all moderate and high hazard jobs. The hazard levels for C-A work planners who are involved in screening are described as follows:

Low-Hazard Work is work requiring the attention of the worker to prevent minor injury. Failure to correctly perform low-hazard work would not damage equipment or structures or release potentially hazardous materials to the environment, except as a result of gross negligence.

Moderate-Hazard Work: Work requiring coordinated actions to prevent injury to personnel, minor damage to equipment or structures, or release of hazardous materials to the on-site environment.

High-Hazard Work: Work requiring coordinated actions to prevent serious injury

to personnel, significant damage to equipment or structures, or releases of reportable quantities of potentially hazardous materials to the off-site environment.

Additional details and specific requirements for work planning for experiments and Users are located in C-A OPM 2.29, " C-A Procedure for Enhanced Work Planning for Experimenters." **Users are required to read and sign the Low Hazard-Skill of the Craft Jobs Signoff Sheet** which indicates they have read and understand the Skill of The Craft work planning incorporated at the experiment. This work planning document delineates the type of work, with it's associated hazards, that Users may perform at an experiment. It is the Experimental Spokesperson's responsibility to ensure that all work is planned in accordance with the intent of the C-A work planning policy.

ELECTRICAL SAFETY TRAINING

If you work on electrical circuits that are powered through circuit breakers, disconnect switches and / or fuses, then you must LOTO the circuits. OSHA, BNL and C-A require that all workers performing these tasks be BNL trained.

The C-A has three courses covering electrical safety that you may be required to take and pass:

- Electrical Safety,
- Lockout / Tagout and
- Working Hot.

Lockout / Tagout and Working Hot training are required if you plan to work with:

- AC voltages greater than 50 Vac,
- DC voltages greater than or equal to 50 Vdc,
- Systems with greater than 10 ma of available current, or
- Systems that are capable of releasing 10 joules or more of energy instantaneously.

If you have questions regarding the electrical safety training requirement for your specific situation, then please contact the C-A ESH Coordinator (x 7200, page 5940, or x 4619, page 5909).

STOP WORK - IMMINENT DANGER PROCEDURES

This procedure provides a policy and process to stop work at BNL to mitigate *imminent danger* to personnel, equipment or the environment. *Imminent danger* exists when there is a hazard that could result in death, serious injury, environmental impairment or significant damage, and when immediate action is required. The person issuing the stop-work order makes determination of the need for immediate action.

Anyone who will be given unescorted status at C-A must first be trained in this procedure. Only persons trained in this procedure have stop-work authority. For example, casual visitors to BNL and other untrained individuals do not have this stop-work authority. Persons who are not trained for unescorted access are still expected to

call attention to any questionable or unsafe act or condition. C-A management takes such notification seriously and makes an evaluation of the unsafe act or condition.

C-A managers and supervisors are not allowed to start hazardous work unless the involved worker(s) are trained and qualified in this stop-work procedure.

Persons are responsible for and expected to issue a Stop-Work order for *imminent danger* whenever it is observed. If an employee is reassigned to work for another supervisor for a period of time, the new supervisor must ensure facility specific stop-work training is conducted prior to allowing work to commence.

This procedure is used to stop work when conditions that are interpreted to constitute imminent danger occur. Other procedures shall be used to prevent people from taking unnecessary risks with lesser hazards or for stopping radiological work.

Any person who reasonably concludes that an *imminent danger* exists and that immediate action is required to mitigate the danger is obliged to take action to stop work. An *imminent danger* exists if proceeding with work could result in death, serious injury, or significant unexpected environmental or equipment damage. A person who concludes that an *imminent danger* exists must consider whether stopping work immediately or proceeding to a safe stopping point constitutes the greater danger.

Procedure

1. The initiator of a Stop-Work order for *imminent danger* shall state the following:
   "*Stop work! You are in imminent danger because…*"
2. Any person receiving a Stop-Work order shall stop work immediately, if that can be done safely, or at the first opportunity to stop safely.
3. The person issuing a Stop-Work order **must not** verbally or physically interfere, whether or not the recipients of the Stop-Work order continue to work.
4. After the work is stopped, the recipient of the Stop-Work order shall notify his/her supervisor (Liaison Physicist) and his/her ES&H Coordinator that a Stop-Work order was issued, and of the nature of the *imminent danger* that exists.

The person initiating a Stop-Work order shall identify him/herself to the affected workers as soon as it is safe to do so. In turn, the supervisor of the involved work shall notify his departmental management.

If the person issuing the Stop-Work order feels that the recipient(s) of the order failed to take appropriate action, then the initiator of the Stop-Work order shall notify his/her own supervisor (Liaison Physicist) and the C-A ESHQ Division Head (x5272, pager 4820). If more than one Department is affected by the Stop-Work order, then the person initiating the Stop-Work order shall notify the C-A ESHQ Division Head and the ES&H Coordinator of the other Department.

The supervisor and the ES&H Coordinator shall investigate and evaluate the need for further action or internal or external reporting. Management shall resolve appropriate issues in cases where the recipient of a stop-work order is not compliant with this procedure. There will

be no reprisals by anyone for issuance of a stop-work order.

Following a stop-work order, the C-A Department Chair or designate shall determine, with advice and counsel from the ESHQ Directorate, the conditions that must be met before work may resume. Input into conditions for restart shall also be sought from the person who initiated the stop-work. Work shall not be resumed until appropriate corrective actions and safety reviews are completed and the responsible manager authorizes restart.

RADIOLOGICAL STOP WORK PROCEDURE

This procedure provides a mechanism for trained Laboratory employees, guests, and contractors to stop radiological work that does not meet Laboratory requirements or creates the threat of radiological exposures or releases. This radiological stop-work procedure utilizes the requirements and processes established in the imminent hazard procedure, except that different criterion is described for the conditions under which a radiological stop-work order may be given. Because of the nature of radiological work, stop-work criteria are provided for certain situations that would not be considered "Imminent Hazard."

Improvement of radiological performance is a high priority at BNL. All workers trained in the radiological stop-work procedure have the responsibility to improve performance by providing careful attention to his/her performance and to that of co-workers. In support of this procedure:

- Each worker is expected to point out and insure correction of poor radiological work practices whenever they occur. In most cases, all that should be necessary is calling attention to the problem.
- All workers are expected to respond positively to radiological cautions provided by a co-worker.
- There may be situations where a formal stop-work is necessary. Any worker trained on this procedure is authorized to stop radiological work when the conditions defined in the following are met.
- All personnel are expected to immediately abide by a stop-work instruction.

It should be noted that the supervisors do not need to invoke a Stop-Work Order in exercising their normal responsibilities to monitor work in progress and to ensure proper adherence to BNL practices.

Whenever poor radiological performance is observed, workers should provide immediate advice to correct the problem**.** In most situations, a formal stop-work is not needed. The concern should be addressed quickly without participation and review by other than the involved workers. The imminent occurrence of the following examples are the types of situations that should be immediately corrected with a cautioning:

- Entry into a Controlled Area without proper training or escort.
- TLD worn on the wrong location on the body.
- Work about to begin without observing expected requirements.
- Removal of material without observing exit survey requirements from a location controlled as a Contamination or Activation Area.
- Beginning work without adequate Work Planning or training qualification.

- Touching the face or other exposed skin while working in a contamination area.
- Survey for radioactivity performed in a hasty manner.
- Disturbance of radiological postings or barriers.

Each of these activities, if not promptly addressed, could lead to a violation of federal and BNL radiation protection requirements.

There may be occasions when an employee observes a practice that is most likely a violation already, or possesses the potential to result in significant radiological exposure or release of radioactive material. In these situations, the work should be immediately stopped through a formal "Stop-Work" instruction; and follow-up reviews conducted to correct the problem prior to work continuing.
Examples of this type of situation are:

- Discovery of work that is being conducted without adequate Work Planning, such as work in a High Radiation Area or a Contamination Area without a RWP.
- Blatant or repeated disregard of established radiological requirements or direction from a Radiological Controls Technician (RCT).
- Operation of radiation-producing equipment with interlocks bypassed without prior review and approval.
- Radiological controls that are inadequate for work in progress as evidenced by:
  - Unplanned exposures greater than 25 mrem to a visitor or minor, or greater than 100 mrem to a worker.
  - Two or more skin contaminations during any single phase of the work.
  - Any single skin contamination >50,000 dpm/100cm^2.

In these situations, the work should be stopped by any trained individual using the following language. "**Stop work. You are in violation of radiological requirements because…"**
When a stop-work order has been given, the following actions shall occur:

- All work in the affected activity shall stop as soon as possible.
- The work place shall be placed in a safe condition.
- All workers shall report to the responsible line manager.
- Work shall not resume until appropriate safety reviews are performed and restart is authorized by the C-A Department Chair or his designate, subject to the advice and counsel of the affected ES&H Coordinator(s) and the BNL Radiological Control Manager.

REMOVING DAMAGED EQUIPMENT FROM SERVICE

If any equipment presents an immediate hazard that could reasonably be expected to cause serious injury or environmental harm, then you must remove it from service (e.g., broken ladders, frayed slings, defective power cords, leaking tanks).

ACCOUNTABILITY FOR NOT FOLLOWING THE RULES

Perform exactly the requirements in C-A procedures or cause those requirements to be officially changed to what the C-A Department needs. This policy applies to all

C-A Groups and will be enforced everywhere. You will be held accountable to follow rules and procedures for which you have been trained.

STAFFING LEVELS AND SAFETY

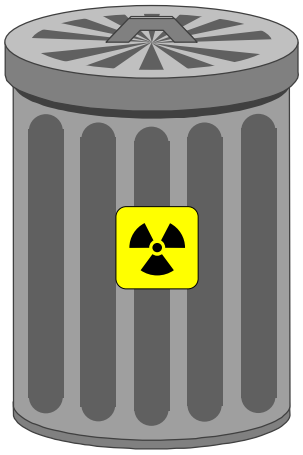
Rules shall be followed even when you are short handed. Each experiment may have specific safety instruction, training, and rules. The C-A complex as well as the Laboratory also have specific rules, Do not violate safety rules to get the job done. For example:

- Obey traffic rules on site (30 mph Speed Limit).
- Do not climb on cable trays, use appropriate ladders and man lifts.
- Do not overexert your self in lifting heavy objects, get assistance.
- Be aware of environmental conditions, take appropriate measures when working in outdoor conditions during heat stress alerts.
- Be sure you are trained for the task at hand, i.e. Crane Operators Training to use overhead cranes, working on electrical equipment requiring Electrical Safety Training, Radiation Safety Training to work in radiation areas.
  The ES&H Coordinator (x 7200, page 5940, or x 4619, page 5909) can provide you with the necessary information.

WASTE DISPOSAL

CAUTION:

Improper disposal of radioactive or hazardous waste may result in fines, criminal prosecution, and facility shutdown. Contact the C-A Environmental Coordinator (x7520) prior to establishing any airborne, liquid or solid radioactive- or hazardous-waste-stream. The C-A Environmental Coordinator is familiar with rules, permits, authorizations and analysis requirements necessary for proper disposal



Removing waste from the Laboratory is complex and costly. Your cooperation is necessary in order to control waste according to Federal, State, and Suffolk County regulations. Additionally, the regulations of States where waste from C-A is ultimately disposed of must also be followed.

- Do not place clean materials in the radioactive waste bins.

- Do not place radioactive materials in the green 3-yard bins used for clean waste.
- Substitute reusable materials where possible.
- Use minimum quantities of materials.
- Segregate wastes.
- Do not leave unnecessary items in primary areas.

Each person is responsible to ensure that they handle, accumulate or dispose of waste by using adequate and proper controls and documentation. Waste generators at the C-A must check all waste to ensure that it is not radioactive. Generators of hazardous or radioactive waste at the C-A should minimize the amount of waste they generate by substituting re-usable materials where possible, irradiating or using minimum quantities of materials, and segregating different wastes to allow for reclamation.

Hazardous waste is subject to time limits and volume limits that must be strictly adhered to. Generally, accumulation of more than 55 gallons at a satellite accumulation area is not allowed. Once the waste is moved to the C-A Hazardous Waste Trailer, a 90-day clock starts. The waste must leave the C-A complex within this 90-day period. Containers must be appropriate for the type of waste being collected and be dated and labeled. Your cooperation in this area is important in order to maintain C-A's good reputation in the surrounding community.

Activated lead is an example of mixed waste. It is both hazardous and radioactive. Do not put mixed waste in radioactive waste cans. Aside from activated Pb, another example of mixed waste is activated oil.

Do not throw clean metals into waste cans used for ordinary clean waste. Non-radioactive metals should be re-cycled. Metals in our clean waste stream are a problem since the Brookhaven Town Landfill will refuse BNL's clean waste if they find metal in it.

Question: you have to throw out empty cans of a liquid chemical, which you have used, to clean equipment. You realize the liquid itself may require special handling, but the containers are dry. What do you do?

Answer: initially treat the container as hazardous waste and contact the C-A Environmental Coordinator (x7520) to learn the proper disposal technique.

SPILLS

The C-A is required to report spills. The C-A must report to outside agencies on events that deal with impacting the environment. Even minor events such as spilling any amount of oil in an outdoor area may require reporting. The rules are such that we must *consider* reporting spills of any type or size. IF you spill any liquid inside or outdoors, THEN contact the Experimental Spokesperson or the Liaison Physicist. They in turn will contact the ES&H Coordinator (x 7200, page 5940, or x 4619, page 5909) or the C-A Environmental Coordinator (x7520) as appropriate for the spill conditions. DO NOT leave a message on an answering machine. IF you cannot contact the above personnel, THEN call the Main Control Room (x4662). Report the spill giving your name plus information on the location of the spill and the type of material involved if you know it.

SPILLS THAT DO NOT HAVE TO BE REPORTED

Spills that occur as a result of routine operations do not have to be reported so long as all of the following conditions are met:

- The spill occurs indoors.
- The spill occurs on an impermeable surface.
- The material spilled in not a highly toxic or highly volatile material (such as methylene chloride).
- The material spilled is not known to contain (or suspected to contain) polychlorinated biphenyls (PCBs).
- The person responding to the spill has appropriate training and materials to clean up the spill.
- The spill is cleaned up immediately.

The Experimental Spokesperson and/or the Liaison Physicist are to be contacted in the event of any spill to evaluate and coordinate clean up efforts.

ENVIRONMENTAL MANAGEMENT SYSTEM

The goals of the Environmental Management System (EMS) are to ensure that you know and comply with environmental regulations associated with your work. That you know the potential environmental aspects and impacts associated with your work and how to prevent, respond and mitigate impacts. Strive to practice the techniques of pollution prevention and waste minimization.

There are five points to BNL's EMS policy and commitment.

1) Compliance

Comply with all applicable environmental requirements.

2) Pollution Prevention

Strive to prevent pollution, minimize wastes and conserve resources.

3) **Clean Up**

Aggressively correct and clean up existing environmental problems.

4) **Continual Improvement**

Protect our ecosystem and community by continually improving the way we manage our programs.

5) **Community Outreach**

openly communicate our progress and performance to our community and stakeholders.

ACCOUNTABILITY AND RESPONSIBILITY IN ENVIRONMENTAL PROTECTION

Everyone associated with Brookhaven National Laboratory has a role and responsibility in BNL's commitment to cleaning up the environment. You are accountable for any potential to impact the environment. You must understand , be responsible, and accountable for impacts that your actions have on the environment. If you are unsure of how an assignment may impact the air, water or soil, it is your job to contact the Experimental Spokesperson or Liaison Physicist. Your individual responsibility in environmental protection include:

- Compliance with BNL Environmental Policy
- Adherence to environmental regulations and requirements
- Reporting any spill or release of hazardous or toxic material to the soil, water, or air.

COMPRESSED GAS SAFETY

All compressed gases are hazardous due to high pressure

Because of the different hazards associated with different gases, it's important that cylinders be properly labeled. When a cylinder is delivered to the gas warehouse, a laboratory, or a job site, it should have:

- **content identification**,
- **DOT label**, and
- **a valve protection cap**.

UNDER NO CIRCUMSTANCE should the means of identification be removed from a cylinder. The valve protection cap should remain in place until the user has secured the cylinder to a fixed support at the point of use and is ready to attach a pressure regulator to withdraw the contents.

The personnel at the BNL Gas Warehouse will attach a Cylinder Status Tag on the cylinder when it is delivered. Tear off the bottom of the Cylinder Status Tag and write name of assigned user on tag indicating the cylinder is in use.

GENERAL RULES FOR CYLINDER HANDLING

- Do not drop cylinders or permit them to violently strike each other.
- Do not roll cylinders in a horizontal position.
- Do not drag cylinders.

- Do not handle cylinders with oily hands or oily gloves. This is especially important when handling oxygen and other oxidizers.
- If hoisting is necessary, use a suitable cradle or platform.
- Do not lift a cylinder by its cap.
- Keep cylinder caps on the cylinder whenever they are not in use.
- Transport cylinders using a cart or hand truck designed for that purpose.
- Whenever placing a cylinder in service, check the hydrostatic test date.

COMPRESSED GAS CYLINDER SAFE STORAGE

- Storage areas should be dry, cool, and well ventilated, and where practical, fire resistant.
- Gases of different types are to be grouped by type and non-compatible types should be separated. Flammable gases shall not be stored with oxidizing gases.
- Cylinder storage areas are to be prominently posted with the types of gases stored.
- Charged and empty cylinders should be stored separately.
- Cylinders should be arranged so that old stock can be removed first with a minimum handling of other cylinders
- Cylinders should not be stored at temperatures above 125 ^{0}F, (51^{0} C) or near sources of heat.
- Cylinders should not be stored near highly flammable or combustible materials.
- When cylinders are being moved on a cylinder cart, they must be secured to the cart

FIRE OR OTHER EMERGENCY

In your work area area, then make a mental note of:

- Exits.
- Fire Alarm Pull Boxes.
- Crash buttons.
- Crash cords.
- Inter-phones, house-phones or PA systems.
- Emergency exhaust, if any.
- Telephones.

Question: you need immediate help in an emergency. What do you do?

Answer: pull a fire alarm box <u>and</u> call x2222 or x911. This is the preferred method to contact the emergency response team.

Question: there is a fire near the tanks on your acetylene-welding unit. What do you do?
Answer: warn others and evacuate the building.

In any emergency, one can and is encouraged to pull a fire alarm box; it does not have to be a fire. Fire alarm boxes are located throughout the complex, at the experimental halls, and the collider tunnel. They are the best method to simultaneously alert MCR and the ESH Fire/Rescue Group. Pulling a fire alarm box and telephoning 911 or 2222 brings the Fire/Rescue Group to your specific alarm-box location within two minutes, and appropriate additional personnel can be summoned right away.

Rings are restricted spaces. If fire should break out, then smoke could quickly impair visibility, and asphyxiation from contained gases can occur.

In the Collider Tunnel, vertical and horizontal emergency exits alternate and are located throughout the tunnel. At the experimental intersection areas there are multiple horizontal exits. All exits go to the inner ring road.

Once outside a smoky area, report to the Local Emergency Coordinator (LEC) or the Department Emergency Coordinator (DEC) if they are present. They will be wearing baseball-like caps marked DEC or LEC. Do not chat with the Fire Captain or other emergency response personnel in the area. Obey the directions of the Fire Captain, DEC or LEC.

C-A ALARM SIGNALS

If you are inside a C-A primary area, you must obey the emergency signals as follows:

RESPONSE TO FIRE ALARMS

If you hear an Intermittent Fire Alarm Bell, evacuate the area after placing equipment in a safe operating mode. The Main Control Room Personnel, Operations Personnel, and Hydrogen Target Watch Personnel must remain on station if they have emergency duties, but will evacuate during imminent danger situations. Personnel will then assemble in the designated Assembly Area. If you hear a continuous Fire Alarm Bell evacuate the area through the nearest exit. Assemble at least fifty feet from the building or at the designated outside assembly area and obey the directions of the Fire Captain, DEC, or LEC.

RESPONSE TO FLAMMABLE/EXPLOSIVE GAS ALARMS

If you hear a two-tone horn in the collider experimental areas complex accompanied by a yellow strobe, evacuate immediately and report to an outside assembly area.

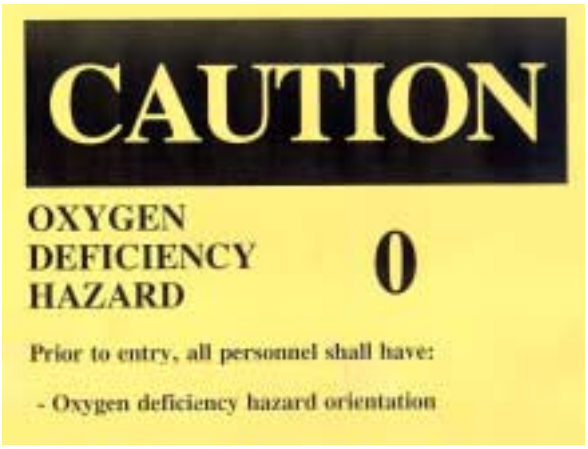
BNL SITE SIRENS

- IF you hear a continuous site-wide siren for five minutes, THEN leave the area and assemble in the indoor assembly area posted on all entrance doors.
- IF you hear a pulsating site-wide siren, THEN evacuate the BNL site.

The site evacuation plan covers other facilities on-site. The site sirens are tested each Monday at noon.

ACTIONS FOLLOWING AN INJURY/ILLNESS

- If there is an emergency involving an injury or an illness such as a heart attack, then pull the fire alarm box, and call x2222 or x911. IF you are injured on the job, then report as soon as possible to the BNL Industrial Medicine Clinic, which is located in Building 490. Your supervisor or Liaison Physicist should accompany you. If your supervisor is not available, you must call upon another member of supervision or management in your Department or Division to go with you. In most circumstances, it is expected that you report to the clinic immediately after the injury. If this is not possible, you are required to notify the Clinic immediately and report to the Clinic with your supervisor, or alternate member of management, before the end of the work shift in which the injury occurred, or at the start of your next work-shift. If you fail to notify and report to the Clinic as required, any resulting missed work may be considered unauthorized leave and will be ineligible for sick leave.



OXYGEN DEFICIENCY HAZARDS

What is oxygen deficiency? Normal atmospheric content is 20.9% oxygen, 78% nitrogen, and 1% argon. Oxygen deficiency is defined as less than 19.5 % oxygen. This happens when air in an enclosed space is displaced by another gas.

What causes oxygen deficiency? Cryogenic systems use large amounts of helium and nitrogen. Both liquids expand about 700-800 times when released into air. This could happen quickly with a major release as a result of catastrophic failure. In a major release, one might see a rapidly expanding white cloud and hear a "whooshing " sound. The leak could also be slow, invisible and silent. Both helium and nitrogen are colorless and odorless.

EFFECTS OF OXYGEN DEFICIENCY

The following table summarizes the health effects of oxygen deficiency.

Volume % O	Effect on Healthy Person	Approximate Time
17	Deep Breathing Faster Heartbeat	Rapidly
16	Dizziness, Slower Reaction Time	Rapidly
15	Impaired Attention And Coordination, Intermittent Breathing, Rapid Fatigue, Loss Of Muscle Control	Rapidly
12	Very Faulty Judgement, Inability To Move, Loss Of Consciousness, Brain Damage	10 Min 10 Min 2 Hours
10	Inability To Move, Nausea, Vomiting, Loss Of Consciousness	4 Min 10 Min
6	Loss of Consciousness Coma Death	30 sec 1 min 5 min

CLASSIFICATION LEVELS OF ODH

There are five ODH classes: 0 through 4, with 0 being the least hazardous. Classification is based on the likelihood of fatality. There are no areas at RHIC or C-A with a classification greater than Class 1. Two areas, 1005R refrigerator and g-2 refrigerator are Class 1. Additional control measures and training are required for entry into a Class 1 ODH area.

This access training allows you to enter the following Class 0 areas at C-A:

- Experimental Halls
- Collider Buildings with valve boxes.
- Support Buildings 1002B, 1004B, 1006B, 1008B, 1010A, 1012A, and additional service buildings.
- Compressor Buildings 1005H and 1005E.
- Collider Tunnel

WHEN IS EVACUATION OF AN ODH AREA REQUIRED?

Any one or combination of the following requires an immediate evacuation of an ODH area:

- The in-place oxygen monitors set off an alarm. At the RHIC complex, Blue strobes lights accompany the audible alarms.
- A vapor cloud is observed inside the ODH area or a loud "whooshing" sound is heard (even if no alarm sounds).

The evacuation procedure is as follows:

- Leave the area, moving away from any vapor cloud or other potential problem.
- Stay Low! Do not use vertical escape exits, use only horizontal exits.
- If someone is in danger, hurt or feeling ill, call 2222 or 911. Otherwise, call the Control Room.

It is important to remember that you should not re-enter even with an escape pack. Let the Fire/Rescue Group handle it. ODH deaths usually come in pairs; more than 50% of ODH deaths are of would be rescuers. One or two breaths could cause loss of consciousness under certain conditions, and lung damage is possible if the gas cloud temperature is -50 to -70 ºC.

EMPLOYEE CONCERNS PROGRAM

The Laboratory wants your work related problems and complaints to be solved fairly and promptly. Many problems can be resolved by working within the supervisory structure of the department. If for any reason this approach does not work for you, the BNL Employee Concerns Program offers employees a different alternative. The Employee Concerns Program is designed to give employees the opportunity to confidentially communicate issues of concerns related to waste, fraud, and abuse of health, safety, and environmental issues when they feel unsatisfied with the response of the line management or ES&H specialist. Contact Susan Foster ext. 2888.

OUTDOORS SAFETY CONCERNS

All New York State laws must be followed. The site speed limit is 30 mph. Obey all parking and traffic postings. The deer on site also present a driving hazard to which you should be alert.

On the BNL site you will see a variety of wildlife. Many of the deer and some other animals carry the deer tick, which can transmit Lyme disease. Avoid high grass and wet wooded areas. For more information about Lyme disease contact the C-A ES&H Coordinator (x 7036, pager 6152 or x7200, pager 5605) or the Occupational Medicine Clinic.

COUNTER-INTELLIGENCE PROGRAM

The Department of Energy is known worldwide as a stronghold of scientific expertise, and as such, is of prime interest to foreign intelligence services. To help protect it's interests, the DOE established the Counterintelligence Program. All BNL employees are required to report contacts with foreign nationals and all travel to sensitive countries. For information about this program or to report any concerns contact the BNL Counterintelligence Program Manager (x2234).

LABORATORY COMPUTERS

Laboratory computers are provided to staff in order to support Laboratory operations. You must be authorized to work on a computer and use it in accordance with BNL requirements. The BNL Computer Users Agreement defines the acceptable parameters for computer use.

You are responsible for the security of your computer and its stored data. Information created, stored, and processed at BNL is considered BNL property and must be protected. If at any time, you suspect that

the security of your computer has been compromised, contact your supervisor immediately.

BNL SECURITY

The Police Group, part of BNL's Safeguards and Security Division, is responsible for providing protection to BNL employees, property, and equipment, as well as controlling sensitive and classified information.

Identification badges, security clearances, and property passes aid in the security process. Photo identification badges are issued to all employees, visitors and guests. ID badges should not be left in the open. If you loose your ID badge contact the Security Division to have another issued.

A property pass is required any time you remove BNL property from the site. BNL reserves the right to inspect and search vehicles entering or leaving the site. For more information about security or if you are required to work with sensitive material contact Security Division (x2238)

the job right the first time. There is only a cost for failure, and experience shows this cost can be spectacular.

SPECIAL REQUIREMENTS FOR SPECIFIC EXPERIMENTS

Consult the Liaison Physicist for up-dated specific safety instructions concerning your experiment.

PHENIX

1. This course does not qualify or certify anyone to perform work in the PHENIX Interaction Region (IR) or Assembly Hall (AH). The following general rules apply for all work in these areas.

- Authorization is required and additional job specific training may be required by BNL, C-A, or PHENIX for electronic, electrical, gas, or other potentially hazardous work in either the PHENIX IR or AH.

- All persons requiring access to elevated work platforms and scaffolds which are part of the PHENIX Access System in the IR area must read and acknowledge the PHENIX Fall Protection document.

- PHENIX has a two person rule while working in the IR area and AH. No individual may perform work in these areas without another person present.

2. Entry/Egress and Safety Considerations for the PHENIX IR:

- Normal entry and exit to the IR area is permitted ONLY through the plug door when the main shielding door is closed. Normal entry and exit is NOT permitted through the labyrinth door. However, both

the plug door and the labyrinth door may be used as emergency exits.

- The PASS cord runs the perimeter of the IR area and may be reached from ground level and from the scaffold on the East Carriage.

- The Emergency Crash Buttons are located on the four walls of the IR and can be activated from ground level.

- Personnel should be aware that PHENIX may use flammable gas in many of its detectors, and proper precautions should be taken.

- PHENIX has no ODH issues at this time.

3. Potential safety hazards and fragile equipment exist in both the IR and AH.

- Electrical hazards, including both high currents and high voltages, are present in both the IR and AH.

- The PHENIX spectrometer magnets should normally be off while any work is being carried out in the IR. However, under certain conditions when the magnets are on, stray magnetic fields may be present. All work to be performed with any magnet on requires Enhanced Work Planning (see below).

- Fragile detector components exist in all parts of PHENIX detector (the East, West and Central Arms), as well as behind the large aluminum panels (North and South Muon Detectors), inside the central magnet poles, and along the beam pipe.

- A fragile beryllium beam pipe runs through the center of the IR.

- A laser system delivers light on fragile optical fibers to several PHENIX detectors. These fibers may only be connected or disconnected by authorized personnel.

- A system of optical data fibers, cables, and electronics exists in many of the electronics racks, and optical fibers run between these racks and the PHENIX Counting House. The optical fibers are very fragile, and work in the vicinity of these fibers should only be done by authorized personnel.

4. Much of work done in the IR may require Enhanced Work Planning. In particular, Enhanced Work Planning and approval from the Work Control Coordinator is required for:

- Working with the Magnet ON in the IR.

- Working near the beryllium beam pipe.

- Working inside or near PHENIX Racks, which have dedicated heat, smoke, temperature, and water detection systems. Work planning is required to avoid tripping these alarms.

- Working near the flammable gas and smoke detectors. Work planning is required to avoid tripping these alarms.

- Working near PASS Cords or Emergency Crash Buttons. Care should be taken to avoid pulling the cords or hitting the buttons.

- With flammable gas in detectors there should be no welding, brazing or other open flame work activities. Also no sparking devices like hand drills, heat guns etc. used without Enhanced Work planning.

- The Crane in the IR may be Locked out when there is flammable gas present in detectors.

STAR

- Fall protection / training required for work performed elevated over four feet.

- A hardhat is required if people are working above you or overhead crane is in operation.

- Lasers are in use in the area.

- Flammable / explosive gas are in the experimental area.

- No loitering about power distribution areas, gas storage / handling areas and transformer yards.

LIAISON PHYSICIST ASSIGNMENTS

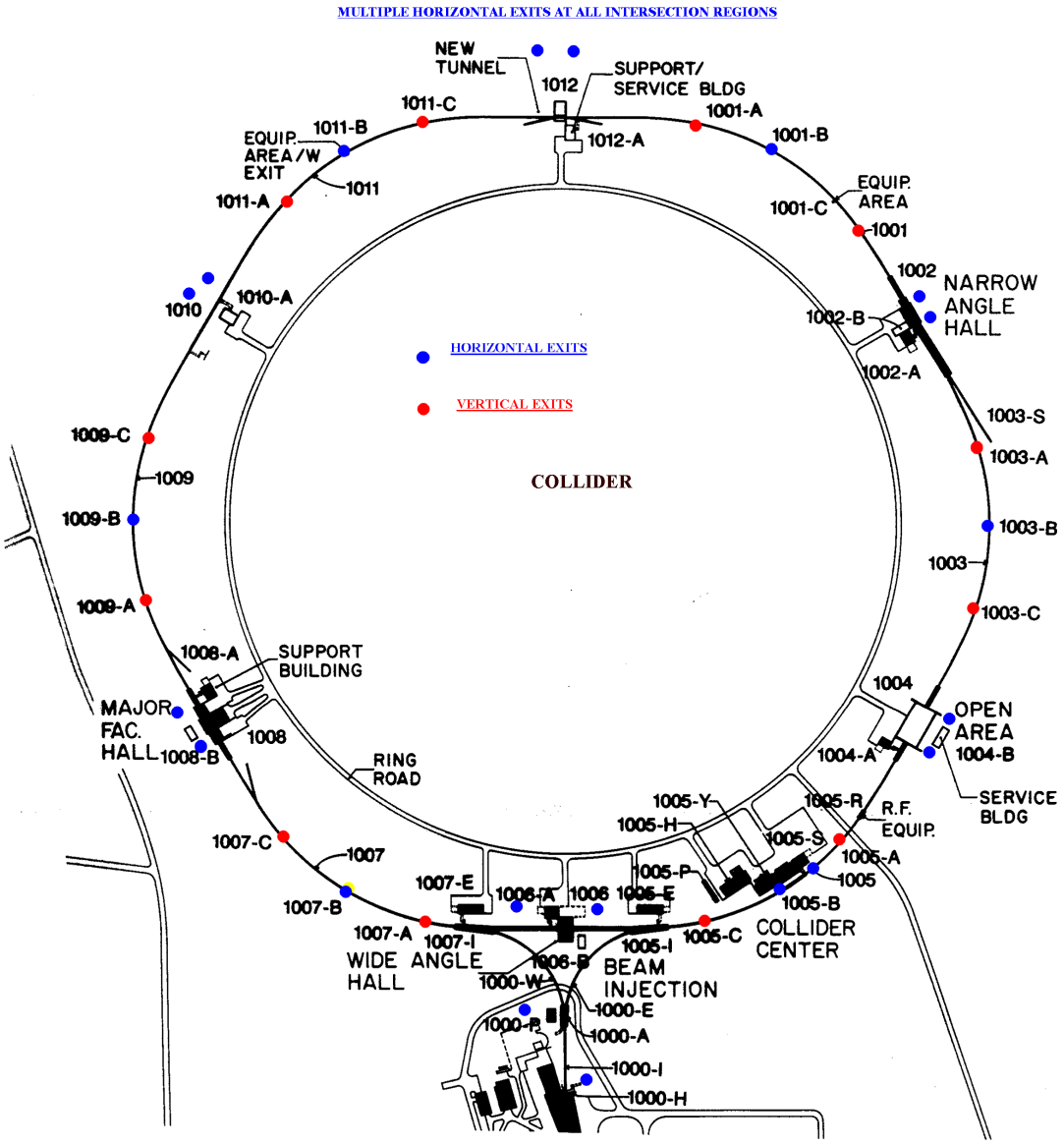
Your Liaison Physicist is your contact for information concerning Environmental, Health and Safety issues concerning the experiment. An up-to-date list of Liaison Physicists is maintained at the web site: http://www.rhichome.bnl.gov/AGS/Accel/SND/Liaisons/liaisons.html

Experiment	Liaison Physicist	Telephone
STAR	A. Stevens	7432
PHENIX	Y. Makdisi	4932
PHOBOS	A. Carroll	4714
BRAHMS	D. Beavis	7124

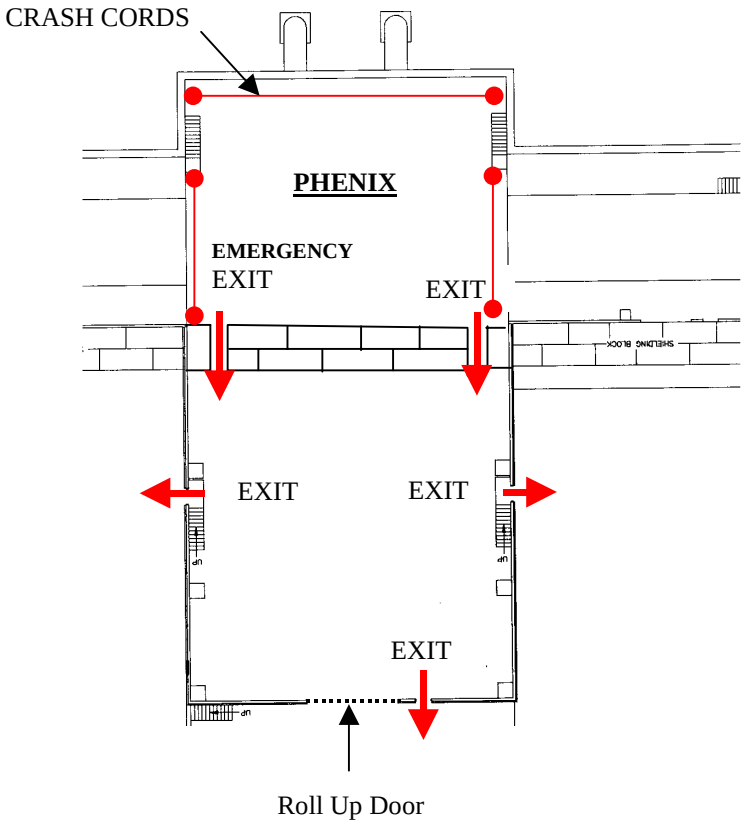
EMERGENCY EGRESS DIAGRAMS

Upon entering any building or experimental area/hall at the C-A complex one should note the locations of emergency equipment as well as the exit points.

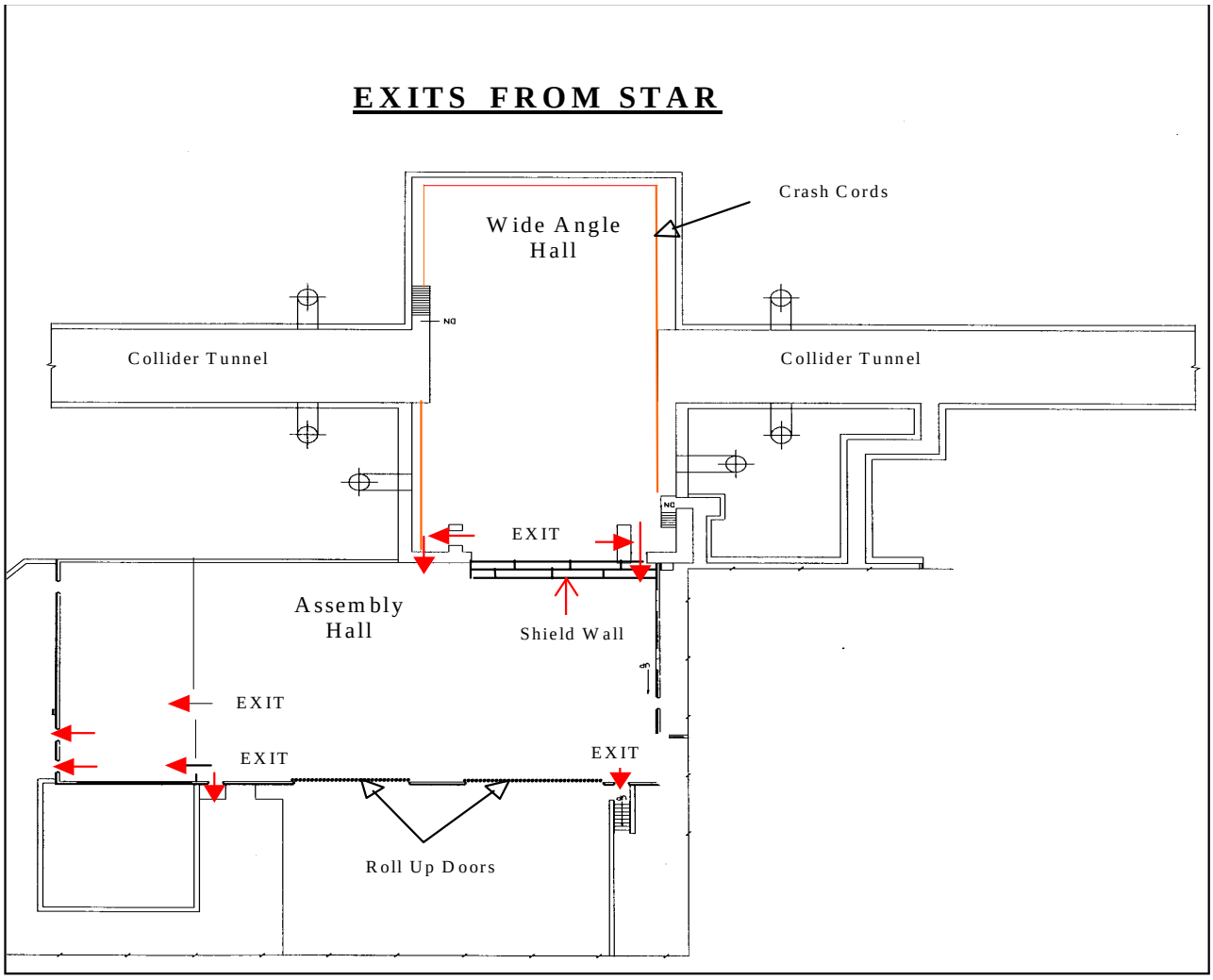
EXITS FROM COLLIDER TUNNEL



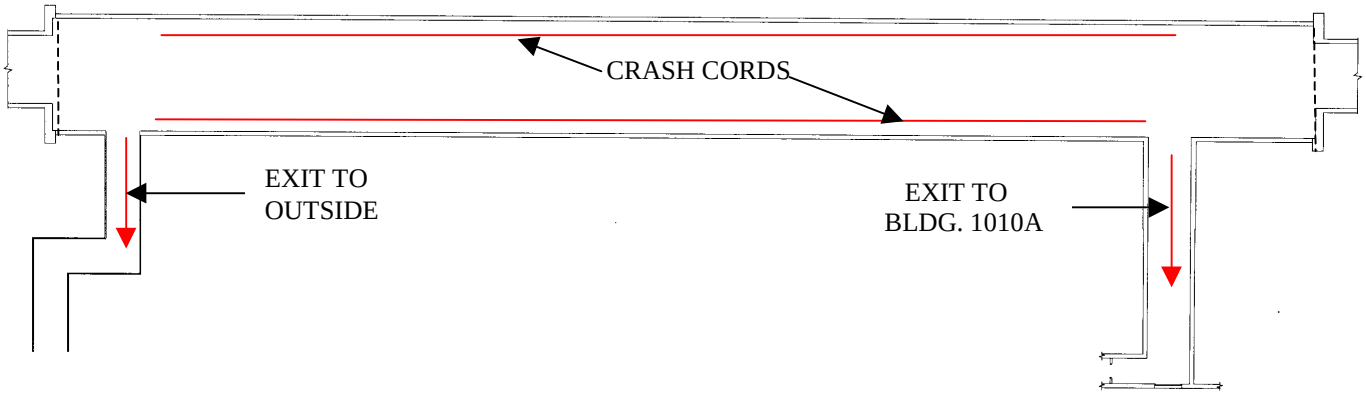
EXITS FROM PHENIX



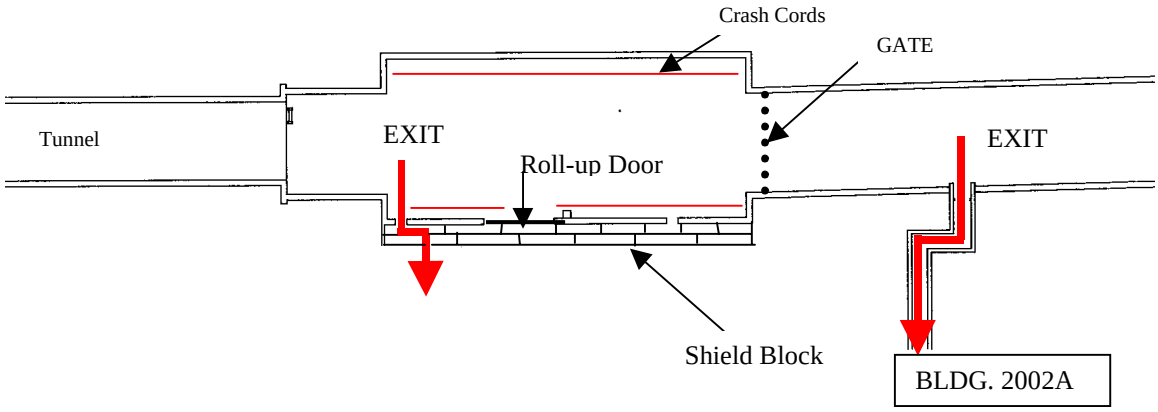
EXITS FROM STAR



EXITS FROM PHOBOS



EXITS FROM BRAHMS



LIST OF ACRONYMS

AGS - Alternating Gradient Synchrotron
ALARA - As Low As Reasonably Achievable
BNL - Brookhaven National Laboratory
BSA – Brookhaven Science Associates
C-A – Collider Accelerator Department
DEC - Department Emergency Coordinator
DOE - United States Department of Energy
ES&F - Experimental Support and Facility Support Division, a Division of the C-A Department
FEB - Fast Extracted Beam
HP - Health Physics
IR – Intersecting Region
LEC - Local Emergency Coordinator
LOTO - Lock Out Tag Out
MCR - Main Control Room
OC - Operations Coordinator
ODH – Oxygen Deficiency Hazard
OSHA - United States Occupational Health and Safety Administration
PAAA – Price Anderson Act Amendments
RCT- Radiological Control Technician
RWP - Radiation Work Permit
SEB - Slow Extracted Beam
SRD - Self-Reading Dosimeter
TLD - Thermo-Luminescent Dosimeter